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Inclusive and beneficial?
Governance in global food value chains in Costa Rica

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Abstract
Global agri-food systems have undergone a rapid transformation towards closer vertical coordination and more stringent food quality and safety regulation. Contractual arrangements can provide farmers in developing countries with a safeguard and thus potentially support investments into farm-level upgrading and standard adoption. We use survey data from 171 pineapple growers in Costa Rica to analyze the determinants of contract choice and the dynamics of standard adoption. Furthermore, we evaluate the effects of different market arrangements on pineapple revenues, transaction risks and relational capital. Our analysis reveals that while contracts represent an important catalyst for farm-level upgrading, major transaction risks in the supply chain remain unsolved. In particular, farmers in formal contract schemes face high rejection rates and long payment delays, which is reflected in low levels of trust in the marketing relationship.

1 Introduction

In recent years, global agri-food systems have undergone a rapid transformation towards higher concentration, closer vertical coordination, and more stringent food quality and safety standards (Swinnen and Maertens 2007, Maertens and Swinnen 2009, Reardon et al. 2009). In particular, exports from developing countries to the EU or US markets need to comply with increasingly complex regulations (Dolan and Humphrey 2000, Henson et al 2005). This offers both opportunities as well as threats to smallholder farmers in developing countries. Many experts emphasize that participation in emerging high-value markets can support farmers in upgrading their production systems and improving their incomes. On the other hand, stringent food safety requirements can pose barriers to the participation in high-value markets potentially marginalizing smaller and resource-poor farmers (Reardon et al 2009).

In the past, the definition and implementation of food safety standards was mostly in the domain of public institutions and regulators. Over recent years, there has been a shift towards private standards that define minimum requirements for produce to enter a specific supply chain (Dolan and Humphrey 2000, Maertens and Swinnen 2009). Some of these standards have become quasi-mandatory, such as the GlobalGAP standard, which has been adopted by a large number of retail chains in major EU markets. With a shift in the standard setting authority from public to private, the question arises who will support farm-level adjustments to the new standard requirements. Public extension services in developing countries often lack the capacities and specialized knowledge to prepare farmers for upgrading and compliance with private standards. This can partly be attributed to the dualistic market structure with low food safety and quality requirements in traditional markets and high requirements in modern domestic and export markets resulting in a food safety and quality gap at the producer level. Public extension services have so far mostly served traditional markets and are usually not equipped to support farmers in overcoming the food safety and quality gap between traditional and modern markets. In response to this, there has been a surge in contract schemes and new institutional arrangements including public-private partnerships that have evolved to provide the necessary support structures to help farmers adjust to the new market requirements (Kersting and Wollni 2012).

Contract schemes vary from rather informal, trust-based agreements to written, legally enforceable contracts. Also, the intensity of the vertical coordination varies from case to case. Simple marketing agreements only specify the quantity and time of delivery as well as a fixed or variable pricing scheme. Production contracts involve much closer vertical interaction where buyers may

provide inputs or perform specific on-farm tasks during the production cycle. Previous studies have argued that contractual arrangements can help small-scale farmers to participate in and benefit from high-value markets with high standard requirements. Contract farming can provide farmers with a safe market outlet thus reducing their risk associated with relationship-specific investments. Furthermore, production contracts can be designed to overcome missing markets providing farmers with access to inputs, credit and extension that is needed to upgrade their production processes.

In this paper we investigate the role of formal and informal private-sector contract schemes for farm-level upgrading and marketing performance in high-value chains. In a first step, we analyze the determinants of participation in formal and informal contract schemes. In a second step, we look at the effects of contract schemes on standard adoption. Finally, we investigate whether farmers benefit from participation in contract schemes in terms of higher net revenues and more sustainable supply chain relationships. We address these questions in the context of a case study carried out with export-oriented small and medium-scale pineapple farmers in Costa Rica. The Costa Rican pineapple sector represents a typical agricultural high-value chain dominated by vertically integrated international agribusinesses with a strong export orientation, which is increasingly regulated by private standards that set product and process requirements. The paper is structured as follows. In the next chapter we provide some background on the Costa Rican pineapple sector and describe the food standards that are of relevance for the export market. In chapter three we introduce the data and methodology used in the study. Chapter four to six present and discuss results and chapter seven concludes.

2 Governance in the Costa Rican pineapple sector

2.1 Coordination and regulatory system

Since the introduction of pineapple as an export crop in Costa Rica, the sector has expanded rapidly (Vagneron et al. 2009), and nowadays Costa Rica is the largest exporter of fresh pineapple in the world. Between 2000 and 2009, pineapple production more than doubled increasing from 0.9 million tons to 1.9 million tons. A major part of the production is destined for the export market, which amounted to 1.5 million tons of pineapples in 2008 (FAO Stat 2011). The main destination markets of Costa Rican pineapple exports are Europe (approx. 52%) and the U.S. (approx. 48%) (CANAPEP 2011). Due to trade agreements, exporters do not incur entry tariffs to access these markets. Both European and U.S. markets, however, are demanding in terms of sanitary and phyto-sanitary standards and public food safety regulations. Furthermore, the importance of private food safety and quality standards has been increasing in these markets over recent years.

The most important food safety and quality standard in the Costa Rican pineapple sector is the GlobalGAP standard, a private collective standard developed by the European Retailer Association. The GlobalGAP standard represents a set of rules defining good agricultural practices, especially related to pesticide use and handling of waste. While being a voluntary standard, GlobalGAP is becoming quasi-mandatory in some countries, e.g. the UK and Scandinavia, because major retailers demand it as a prerequisite (Poissot 2003). The main purpose of the GlobalGAP standard is the harmonization and codification of information along the supply chain, i.e. it is used as a coordination mechanism and not as a marketing tool. Therefore it is not associated with a price premium at the consumer level. Still, in some cases buyers may pay higher prices for GlobalGAP certified products at the producer level to provide incentives to farmers to comply with GlobalGAP regulations (Kersting and Wollni 2012).

Besides food safety and quality standards, sustainability standards have gained in importance during recent years. In the Costa Rican pineapple sector, organic certification and the Rainforest Alliance standard are of particular relevance. The Rainforest Alliance standard, which was developed by the Sustainable Agriculture Network – a coalition of various environmental NGOs, is a voluntary process standard focusing on sustainable production systems. Certification with this standard entitles farmers to use the Rainforest Alliance label on their products as a marketing tool to inform consumers about the sustainability of their product. Currently markets are still limited and there is no secure price premium, however, farmers might benefit in terms of securing access to a potentially growing market (Giovannucci and Ponte 2005).

Similarly, the organic standard is a voluntary process standard that can be used as a signal to producers who are willing to pay a price premium for organically produced products. The International

Federation of Organic Agriculture Movements (IFOAM) has developed basic guidelines that serve as a reference for national and private agencies to develop more specific organic standards. During the past decade, the organic market segment has experienced considerable growth rates in US and EU markets. In response to this, many countries have implemented public standards to regulate the organic sector (Giovannucci and Ponte 2005). Certification with organic standards can be associated with high implementation costs, especially due to long transition periods from conventional to organic production systems. This exposes farmers to major uncertainties regarding future prices of organic produce, given that the price premium is not fixed but depends on market conditions.

The Costa Rican pineapple sector consists of approximately 170 exporters, 72 packing facilities and 1300 producers (CANAPEP 2011). Many exporters are vertically integrated into the processing and production stages, thus disposing of their own packing plants and production units. The majority of the production destined to export markets originates from such vertically integrated production units that are owned by international and national private firms. Only 5 to 10% of the total export volume is produced by small and medium-scale farmers (MAG 2007; Vagneron 2009). The vast majority of these smallholders, approximately 98%, are located in the Huetar Norte region, where around 50% of the pineapple destined for export markets is grown (MAG 2007, CANAPEP 2011). The other two pineapple growing regions, namely the Atlantic (33% of export production) and the Pacific (17% of export production) regions (CANAPEP 2011), are dominated by large-scale integrated production units. Small-scale farmers deliver their produce either to cooperatives or directly to exporters, who impose strict standards in terms of volumes, product safety and quality (Vagneron et al. 2009). To close the gap between the quality and food safety of produce delivered by small and medium scale pineapple growers and the quality and safety requirements of international markets, several exporters have engaged in formal or informal contracts with growers.

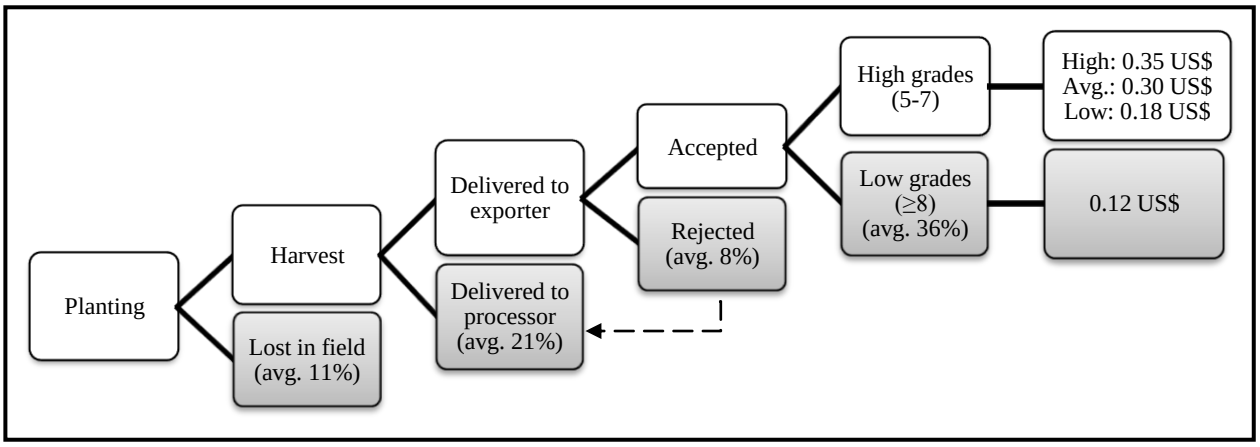
2.2 Transaction risks and asset-specific investments

According to transaction costs theory, asset-specific investments will not occur in a highly uncertain environment without safeguards. Asset-specific investments entail sunk costs that cannot be recovered, if the envisioned market exchange fails. Producers who make asset-specific investments are thus locked into a specific market relationship and exposed to potential opportunistic behavior. Buyers can for example reduce the producers' return on the investment by increasing their quality grading criteria, reducing prices or delaying payment. Having made a relationship-specific investment, the producer finds himself in a disadvantageous bargaining position vis-à-vis the buyer. Anticipating this threat, producers will be reluctant to make asset-specific investments resulting in hold-ups, i.e. profitable investments are foregone as a result of coordination failure (Williamson 1984, Slangen et al. 2008).

In the pineapple sector, producers face multiple risks at different stages of the production and marketing process ranging from weather, yield and price risk to opportunistic behavior of buyers. In particular, pineapple cultivation requires considerable upfront investments into the establishment of the plot, which are estimated to figure around 9000 US$ per hectare (CANAPEP). The majority of farmers take out a loan to finance this initial investment, which leaves them at risk of credit default, if their harvest is damaged or prices are low. Once the pineapple is ripe, farmers face multiple risks throughout the marketing process. First of all, it is important for them to find a buyer at the time of harvest, because the quality of ready-to-ship pineapples quickly deteriorates in the field. That is, at that point, farmers do not have much flexibility to wait and search for a better market option. At the time of harvest, farmers perform a first grading in order to decide how much of their produce they deliver to the exporter and how much is sent to the processing industry. In the processing industry, quality standards are substantially lower, and so are prices. Farmers therefore try to maximize the amount delivered to the exporter, while at the same time taking transportation costs into account. Exporters will reject any produce that does not fulfill their quality standards and send it back to farmers, who then usually deliver it to a processing firm. Farmers bear the full costs of transportation including the cost for the rejected produce. They thus have an incentive to grade their produce as accurately as possible. In the packaging plant, exporters perform a second grading, where grades 5 to 7 are the preferred grades and grades 8 and higher command lower prices. Given that farmers do not assist the process, the grading process often lacks transparency and is potentially subject to opportunistic

behavior on the side of the buyer. Finally, farmers face considerable price risk, which partly stems from seasonal variation and partly from variability in the grading process. During the production season 2011, grades 5 to 7 obtained an average price of 30 US-cents, ranging between 18 and 35 US-cents, whereas grades 8 and smaller obtained a fixed price of 12 US-cents.

Figure 1: Supply chain risks faced by producers



Source: own elaboration, numbers in brackets represent average figures obtained from our survey

We can expect that producers will make more asset-specific investments, if they have a safeguard for their investment. That is, producers are more likely to invest into expanding their pineapple production area, if they have a safe and reliable market outlet. Similarly, farmers will also be more likely to invest into upgrading their production process and adopting food standards, if they have a market outlet they can rely on and where they may receive a price premium for certified produce. Contractual agreements between buyers and producers can represent such a safeguard, as long as they credibly reduce the risk that buyers behave opportunistically once producers have made an asset-specific investment and thus locked themselves into the market relationship.

3 Empirical data and methods

3.1 Survey data

Pineapple production in Costa Rica takes place along the Atlantic and Caribbean coasts and in the northern part of the country, the Huetar Norte region. While the coastal production areas are characterized by large-scale vertically integrated production units, the Huetar Norte region is structurally more diverse. In this area, production units of different sizes and different forms of vertical coordination co-exist. Overall, the Huetar Norte region accounts for 50% of the national pineapple production and for 98% of the small and medium-scale pineapple producers in the country.

The analysis is based on original survey data that was collected in Pital and Guatuso, which are two main pineapple production areas in the Huetar Norte region in northern Costa Rica. The survey was implemented from November 2010 to January 2011. Prior to the household survey comprehensive information about pineapple farming was collected from CANAPEP, the national pineapple organization, as well as from local associations involved in the pineapple sector. Eventually, because no comprehensive and unbiased lists of pineapple farmers could be obtained, pineapple farmers were selected randomly through a random walk approach. For that purpose central locations were identified in the settlements and a direction was randomly determined. In that direction, households were chosen for interviews based on a certain interval, which was determined depending on the size of the settlement (in order to make sure to reach the outer boundaries of the settlement). Households qualified for the interview, if they could be considered small-scale producers of pineapple, i.e., with a pineapple area of less than 50 hectares[1]. If a household was not eligible or available for the interview,

[1] In our definition of small-scale farmers we follow CANAPEP, which classifies farmers cultivating pineapple on less than 50 ha as small-scale. In our sample, farmers cultivate on the average 5.9 ha, including owned as well as rented land. While size varies from a quarter hectare to 45 ha, 80% of the farmers in our sample grow pineapple on less than ten hectares.

it was replaced with the neighboring household until a suitable household was found. Density of pineapple growers is very high in the selected research areas, which are economically dominated by pineapple cultivation. Overall, our sample consists of 173 households, of which two households had to be excluded due to incomplete data. The interview was conducted face-to-face with an adult household member involved in pineapple production. We used a standardized questionnaire to collect data on pineapple production and marketing, standard adoption, as well as on socio-economic household variables.

3.2 Methodology to analyze contract choice

In a first step, we aim to identify the determinants of contract choice. Farmers can choose between three alternative marketing arrangements to sell their pineapple. Firstly, they can sell in the open spot market, i.e., without any prior marketing agreement. Secondly, they can engage in an informal agreement with a buyer, which entails that at the time of planting, they verbally pre-determine the terms of exchange to be followed at the time of harvest. Thirdly, they can enter a formal agreement with a buyer, which implies the signing of a written and legally binding contract. The individual decision to choose a particular market arrangement is modeled in a random utility framework. For farmer i with J choices, the utility of choice j can be expressed as

The farmer will choose a particular market arrangement, when the utility of that arrangement is larger than the utilities associated with all other alternatives, i.e., $U_{ij} > U_{ik}$ for all $k \neq j$. The choice of farmer i is indicated by a random variable Y_i. Furthermore, the disturbances are assumed to be i.i.d. and follow a Gumbel distribution giving rise to the multinomial logit model (Greene 2003). In our case, where farmers can choose between three market arrangements, we obtain the following specification:

In our model, utility depends on X_i, which includes individual-specific characteristics that vary across producers, but are constant across market arrangements. We include several variables related to human capital, specialization, social capital, and accessibility that are likely to influence the probability of a farmer to participate in a particular market arrangement. These variables affect both the ability and preferences of the farmers to engage in contract schemes as well as the interest of buyers to engage with that particular farmer (depending on the transaction costs associated with dealing with the farmer). In general, farmers with better access to resources (land, quantity and quality of human capital) are expected to have better chances to obtain a contractual agreement. Similarly, farmers with better access to information (education, experience, social networks, geographic proximity) are expected to be better informed about contract options and to have better access to potential buyers. Finally, transaction costs matter in the decision to engage in a contract. Market search and contract negotiation costs are to a large extent fixed costs, which makes contract farming more attractive to larger and more specialized farms. Due to the same reason, these farms are also often preferred by buyers. On the other hand, small-scale farmer usually have less outside options, which can make a given contract offer relatively more attractive to them (Key and Runsten 1999).

3.3 Methodology to analyze standard adoption

In a second step, we are interested to explore in how far the choice of a certain market arrangement speeds up or slows down the upgrading process. The underlying hypothesis is that vertical coordination provides a safeguard to farmers and therefore induces farm-level investments. We use a duration model to estimate the effects of participation in formal and informal contracts on the time it takes the farmers to adopt a standard. Duration models estimate the probability that a farmer switches from non-adoption to adoption, given that the farmer has not yet adopted the standard. This probability

is reflected by the hazard function, which resembles the continuous time version of a sequence of conditional probabilities (Burton et al., 2003). The proportional hazard model is specified as

,

where t is the time period and β is a vector of parameters to be estimated. The individual hazard rate is a function of the baseline hazard and a vector of variables $Z(t)$ that shift the hazard multiplicatively. The baseline hazard can be described by different distributional forms, which vary with respect to the assumed course of adoption (Wooldridge 2002). If T has a Weibull distribution, the hazard function is

In this specification, if the hazard rate is monotonically increasing, i.e., it exhibits positive duration dependence implying that the probability of adoption increases the longer the farmer is in the sector. On the other hand, if the hazard rate is monotonically decreasing (Wooldridge 2002).

In our analysis we include all 171 households of which 86 adopted a standard over the observed time period. The remaining 85 households are non-adopters and are treated in the analysis as right-censored observations, i.e., they might adopt the standard at a later point in time. The analyzed adoption spell starts at t=2002 or later for those individuals who entered the pineapple sector after 2002. The vector $Z(t)$ includes both time-variant and time-invariant covariates. Most importantly, we include two dummy variables on the type of market agreement (one for participation in verbal and one for participation in formal contracts) that vary over the observed time spell. Additionally, we include time-variant information on membership in pineapple producer groups. Time-invariant variables include information on human capital, specialization, social capital and accessibility. In general, we expect the variables assumed to influence contract choice also to play a role in standard adoption. Standard adoption is also associated with substantial fixed costs related to initial investments and transaction costs (Kersting and Wollni 2012). Farmers with more human capital, stronger specialization, more social capital and better accessibility are therefore hypothesized to be more likely to adopt a standard. We do not include variables related to the experience in the sector because the length a farmer has been in the sector and its effect on the probability to adopt is implicitly included in the baseline hazard.

3.4 Methodology to analyze standard adoption

Finally, we are interested in estimating unbiased treatment effects of participation in two treatments – participation in formal and informal contract schemes – on various outcome variables. Given that we cannot observe the same contract farmers without contractual arrangements, we need to construct a valid counterfactual in order to derive the average treatment effect on the treated (ATT). This is achieved by matching treatment households on observable characteristics with households from the control group (i.e., farmers without contractual arrangement). In our case, we have two mutually exclusive treatments, defined as if farmers have a verbal agreement and if farmers have a formal contract, and a control group of farmers without marketing agreement ( ). While most of the literature deals with estimating the ATT for a single treatment, the methodology can be extended to the case of multiple treatments (see e.g. Maertens and Swinnen 2009). Given that there is a large number of potentially relevant covariates, matching directly on the covariates is not practical. Alternatively, a one-dimensional indicator, the propensity score, is constructed reflecting the conditional probability of being in the treatment group (Rosenbaum and Rubin 1983). Based on the propensity score the ATT can then be estimated as follows (Becker and Ichino 2002):

where , and are vectors of outcome variables with and without treatment, respectively, and is a vector of covariates used to obtain the propensity score. We use the multinomial logit model specified above to estimate the propensity score. With this specification, we achieve balancing for all of the included covariates. We use radius matching to identify suitable comparison households for the treatment group. Moreover, only households in the common support region are included in the calculation of the ATT. Common support is satisfied when the propensity score of the treated units is not higher than the maximum or lower than the minimum score of the control units (Becker and Ichino 2002).

We consider several outcome variables to represent different dimensions of the marketing relationship. First of all, we look at net pineapple revenue both in total and per hectare. We expect that farmers in contractual relationship make more informed investment decisions resulting in higher monetary benefits derived from pineapple cultivation. Furthermore, we consider several variables related to the terms of the exchange including rejection rate, quality, price and terms of the payment. Given the coordination function of contractual agreements, we also here expect a positive impact of participation in contractual schemes. Finally, we compare relational capital across the different marketing arrangements including trust and loyalty.

4 Contract choice

4.1 Characteristics of marketing arrangements

With respect to the contractual arrangements, we find that 32% of the farmers in our sample have a verbal agreement and 42% have a written agreement with their buyer. The remaining 26% of the farmers have no agreement prior to selling their fruit. In general, input provision is not very common in the Costa Rican pineapple sector. Table 1 shows that through only 3.6% of the verbal agreements and 1.4% of the written agreements, farmers received inputs from their buyer. Overall, input markets function well in the research area so that access to inputs does not represent a major constraint to pineapple producers. In contrast, the extent of credit and extension provision varies significantly between the different marketing arrangements. In the case of written agreements, 55% of farmers received credit and 90% received extension from their buyers. Credit and extension provision is substantially lower in the context of verbal agreements, but still significantly more common than in open spot market transactions. The majority of verbal and written agreements contain some specification of the volumes to be delivered, while the price is fixed very rarely in either type of agreement. In open spot market transactions, by definition no agreements between producer and exporter are made. However, in 33% of the spot market transactions a volume is agreed at the time of harvest before the produce is physically delivered. This reduces the risk of the farmer, as he/she has to bear the cost of transportation to the firm.

Table 1: Description of market arrangements in the pineapple sector

	No agreement N=45		Verbal agreement N=55		Signed contract N=71		
	Mean	Std. dev.	Mean	Std. dev.	Mean	Std. dev.	
Buyer provides inputs	0.000	0.000	0.036	0.189	0.014	0.119	
Buyer provides credit	0.067	0.252	0.218	0.417	0.549	0.501	***a,c
Buyer provides extension	0.067	0.252	0.491	0.505	0.901	0.300	***a,b,c
Agreed on volume	0.333	0.477	0.873	0.336	0.958	0.203	***a,b
Agreed on price	0.000	0.000	0.109	0.315	0.113	0.318	*a

Source: own elaboration; ***[*] significant at 1%[10%] probability of error; a=significant difference between signed contract and no agreement; b= significant difference between verbal agreement and no agreement; c=significant difference between signed contract and verbal agreement.

4.2 Determinant of contract choice

Results of the multinomial logit model on contract choice are presented in Table 2. We find that younger farmers are more likely to participate in verbal agreements as opposed to selling in the spot market. Furthermore, better access to labor and land resources, including more male family members and larger pineapple areas, increases the likelihood of choosing a verbal contract over no agreement.

Finally, membership in a pineapple organization is positively associated with engaging in verbal agreements.

Similarly, more organized farmers are also more likely to engage in a formal contract than to engage in open spot market transactions. Furthermore, farmers involved in formal contract schemes tend to be more educated and more specialized, i.e. they have less nonfarm activities and larger pineapple areas. Membership in social organizations also increases the likelihood of a farmer to engage in formal contracts, pointing to the importance of social networks to gain access to formal contract schemes. Similarly, if the farmer has known the buyer for a longer time, they are more likely to engage in a formal contractual relationship. On the other hand, holding all else constant, farmers with less experience in the pineapple sector are more likely to engage in a formal contractual relationship. This is likely due to the fact that farmers with less experience need more technical assistance, which is often provided by buyers through formal contract schemes. Inclusion of a squared term shows that this relationship is not linear but slows down as more experience is gained.

Comparing farmers engaged in formal contracts with those engaged in verbal agreements, we find that farmers in formal contracts are significantly more educated, but less experienced in the pineapple sector. This again indicates that farmers with long-term experience in the sector are less dependent on the support offered by formal contract schemes. On the other hand, all other factors held constant, the longer the farmer has know the buyer, the more likely they are to engage in a formal contract. Finally, membership in producer organizations and in social groups both increase the farmers' likelihood to engage in a formal contract as compared to a verbal contract.

Table 2: Results of multinomial logit model on contract choice

	Verbal versus none			Formal versus none			Formal versus verbal		
	RRR	std err	sig	RRR	std err	sig	RRR	std err	sig
Secondary school	0.439	0.345		3.296	2.282	*	7.498	5.472	***
Age	0.940	0.020	***	0.964	0.022		1.025	0.022	
Number of female adults	1.337	0.518		1.716	0.728		1.283	0.467	
Number of male adults	1.763	0.531	*	1.132	0.353		0.642	0.175	
Land size (lagged)	1.064	0.037	*	1.072	0.037	**	1.008	0.011	
Farm is main business	2.676	1.999		3.506	2.779		1.310	0.998	
Nonfarm activities	0.737	0.373		0.365	0.207	*	0.495	0.246	
Member in pineapple group (lagged)	4.365	3.811	*	14.570	12.320	***	3.338	1.694	**
Member in social group	0.294	0.360		3.739	2.955	*	12.701	15.477	**
Distance to road	1.013	0.044		0.985	0.052		0.973	0.040	
Known buyer (in years)	1.012	0.009		1.038	0.011	***	1.025	0.009	***
Experience	1.012	0.095		0.746	0.076	***	0.737	0.069	***
Experience squared	1.000	0.003		1.007	0.003	**	1.007	0.003	***
LR $chi^2(26)$ = 96.00***, Pseudo R^2 = 0.2596, Log likelihood = -136.870, N = 171									

Source: own elaboration; ***[*] significant at 1%[10%] probability of error; RRR= relative risk ratio

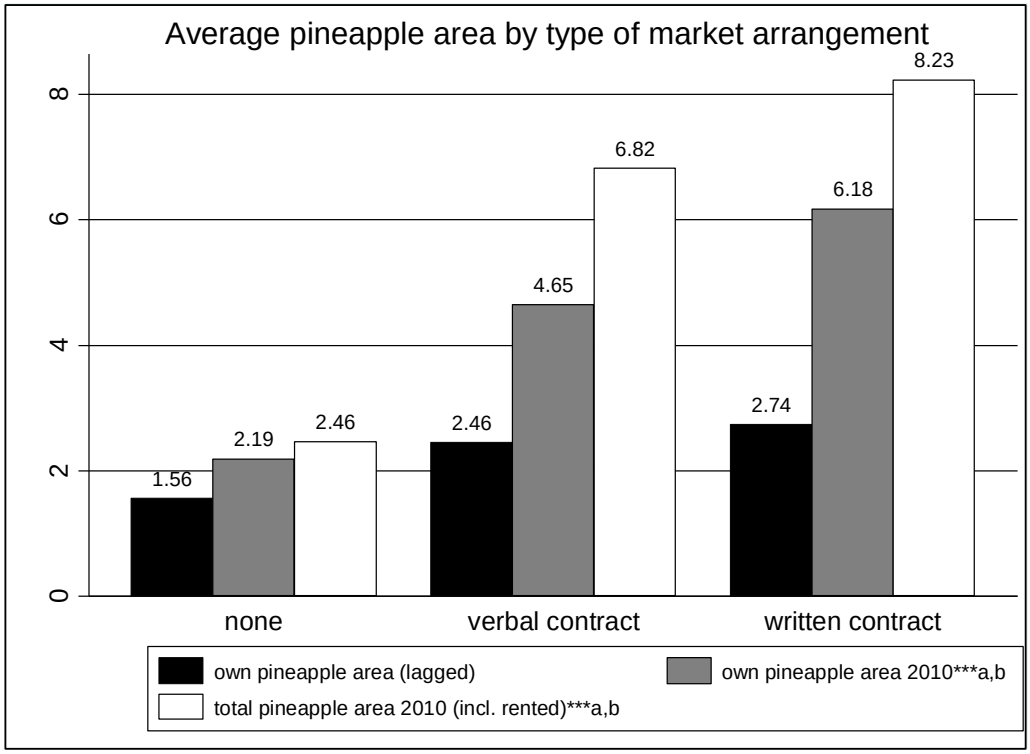
5 Vertical coordination and upgrading

5.1 Investments into pineapple cultivation

As described before, farmers who have a contractual agreement with a buyer dispose of a safeguard and are therefore expected to invest more extensively in upgrading their pineapple production processes. Figure 2 depicts the expansion of land devoted to pineapple cultivation by farmers engaged in the three different types of market arrangements. The black bar indicates the average size of pineapple area owned by farmers when they entered the sector. According to one-way analysis-of-variance and Bonferroni multiple comparison tests, the average size does not differ significantly between the three groups. Subsequently, however, farmers with verbal and formal agreements substantially expanded their pineapple area as compared to farmers who exchange their pineapples through open market transactions. As indicated by the grey and white bars, this applies to both the owned pineapple area as well as the total pineapple area including both rented and own land. According to the graphical depiction, farmers with formal contracts expanded their pineapple area

more so than farmers with verbal contracts, however, the differences between these two groups are not statistically significant.

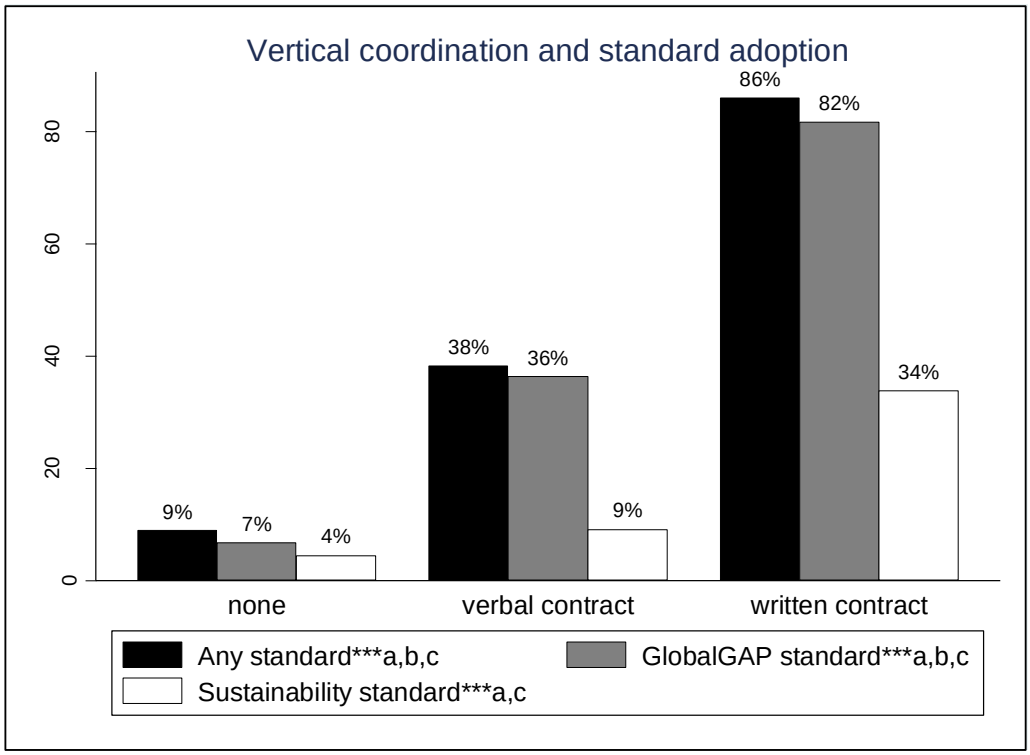
Figure 2: Average pineapple area by type of market arrangement



Source: own elaboration; *** significant at 1% probability of error; a=significant difference between signed contract and no agreement; b= significant difference between verbal agreement and no agreement.

Besides the expansion of land under pineapple cultivation, implementation of food safety and sustainability standards represents a substantial asset-specific investment. Standard adoption is associated with considerable up-front investments that only pay off for the farmer, if better market opportunities can be realized as a result. Presumably, farmers who have a contractual relationship with their buyer can be more secure about their future market outlet, and will therefore be more likely to invest in standard implementation. Table 3 shows the relationship between vertical coordination and standard adoption.

Figure 3: Vertical coordination and standard adoption



Source: own elaboration; Sustainability standard refers to Rainforest Alliance and/or Organic standard; *** significant at 1% probability of error; a=significant difference between signed contract and no agreement; b= significant difference between verbal agreement and no agreement; c=significant difference between signed contract and verbal agreement.

Among farmers engaged in a formal contractual arrangement standard adoption is very common: 82% have implemented GlobalGAP and 34% are certified with a sustainability standard. In contrast, only 38% of farmers holding a verbal agreement and 9% of farmers holding no agreement have adopted a standard to upgrade their production process.

5.2 Dynamics of standard adoption

Table 3 reports coefficient estimates and hazard ratios of the duration analysis. As outlined above, we use the Weibull distributional form to model the baseline hazard, where the shape of the hazard function is estimated with α. In our model, α is significantly larger than one indicating that the hazard rate is monotonically increasing. Given that the choice of the functional form is an empirical matter, we tested different distributional forms for the hazard function. Our results are consistent across different specifications.

The coefficients are interpreted as effects on the hazard rate of adoption. A positive coefficient has a positive impact on the hazard rate, that is, it speeds up the adoption process and vice versa. Table 3 also shows hazard ratios calculated from the coefficients. A ratio bigger/smaller than one speeds up/slows down the adoption process; subtracting one from the hazard ratio results in the marginal effect of the variable on the hazard rate of adoption. The estimates show that participation in both formal and informal contracts has a significant and positive effect, thus reducing the time spell to standard adoption. A verbal contract increases the hazard rate of adoption by 266% and a formal contract by 572%. These results confirm that contract schemes can act as an important catalyst for farm-level upgrading.

Furthermore, we find that organized and more socially connected farmers adopt earlier. Membership in a pineapple producer organization increases the hazard rate of standard adoption by 139% and membership in a social group by 151%. In addition, we find that farm size speeds up the adoption process. This indicates that as expected there are scale economies associated with standard adoption; however, the marginal effect of each additional hectare of land is very small. Finally,

remoteness slows down the adoption process. For each additional kilometer that farmers are located away from the road the hazard rate of adoption decreases by 4%.

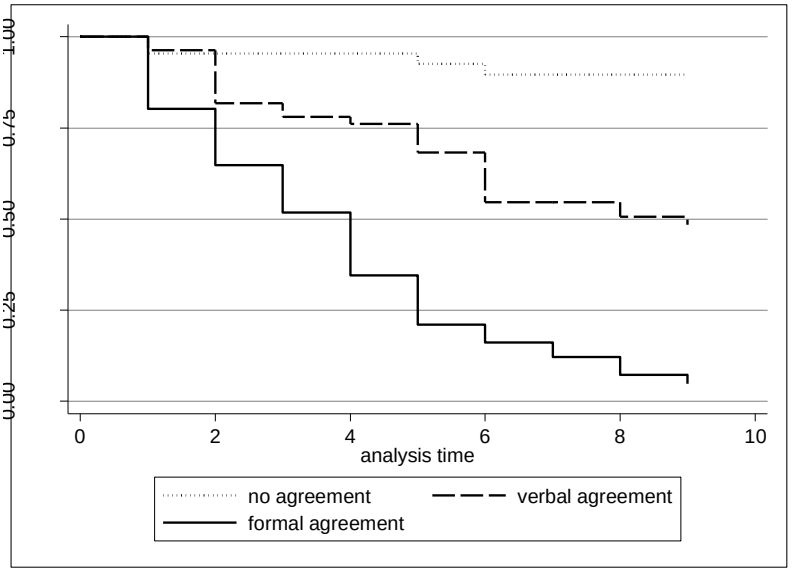
Table 3: Results of the duration analysis

	Coefficient	Robust Std. Err.	Hazard Ratio	Robust Std. Err.	
Signed contract (time variant)	1.905	0.315	6.720	2.118	***
Verbal agreement (time variant)	1.296	0.305	3.655	1.113	***
Secondary school	0.098	0.291	1.103	0.320	
Age	0.008	0.009	1.008	0.009	
Number of female adults	-0.140	0.187	0.869	0.163	
Number of male adults	-0.002	0.116	0.998	0.116	
Land size (lagged)	0.006	0.002	1.006	0.002	***
Farm is main business	0.524	0.343	1.689	0.578	
Nonfarm activities	0.153	0.254	1.166	0.296	
Member in pineapple group (time variant)	0.871	0.274	2.389	0.655	***
Member in social group	0.919	0.426	2.508	1.067	**
Distance to road	-0.038	0.020	0.963	0.019	*
Known buyer (in years)	-0.002	0.004	0.998	0.004	
Constant	-4.695	0.681			***
/ln_p	0.233	0.078			***
p	1.262	0.098			
1/p	0.792	0.062			
Log pseudolikelihood = -143.918					
Wald chi²(13) = 171.20***					
No. of obs./ Time at risk = 924					
No. of subjects = 171					
No. of failures = 94					

Source: own elaboration; ***(**)[*] significant at 1%(5%)[10%] probability of error.

Figure 4 presents a graphical illustration of the survival probabilities by market arrangement. For each time interval, the survival probability is calculated as the number of non-adopters (i.e., the number of farmers at start minus the number of adopters) divided by the number of farmers at start. To obtain the cumulative probability of survival until any particular time we multiply all the probabilities of survival of the preceding time intervals. For example, the probability of a farmer not adopting a standard after two years equals the probability of non-adoption in the first year multiplied by the probability of non-adoption in the second year given that the farmer did not adopt during the first year. From the graph we can see that after nine years farmers who sell in the open spot market have a much higher cumulative survival probability, i.e., a much higher probability to remain without standard, compared to farmers with formal and verbal agreements.

Figure 4: Kaplan-Meier survival estimates by type of agreement



Source: own elaboration

6 Sustainability of marketing relationships

While formal and informal contracts facilitate upgrading and standard adoption, eventually it is of interest not only whether these investments take place but also in how far they result in higher net revenues and better market access for farmers. We therefore use propensity score matching to compare various outcome measures across producers engaged in different forms of vertical coordination. Table 4 gives an overview of the outcome measured and reports the mean values and standard deviations of unmatched cases by market arrangement. We consider three different categories of outcome measures: overall net revenues derived from pineapple cultivation, transaction risks, and relational capital that describe different dimensions of the quality of the marketing relationship from the perspective of producers.

Table 4: Description of outcome variables (unmatched cases)

	Signed contract Mean N=71	Std.dev	Verbal agreement Mean N=55	Std.dev	No agreement Mean N=45	Std.dev	
Net revenues							
Net revenue from pineapple	18124.10	24219.93	17913.45	20919.24	6979.08	11806.11	***a,b
Net revenue per ha	2417.01	3668.57	3245.88	5951.04	4744.76	9406.94	
Transaction risks							
Pineapple rejections (in %)	0.112	0.217	0.066	0.081	0.045	0.060	**a
Informed about reason	0.535	0.502	0.709	0.458	0.400	0.495	***b
Percentage graded as high quality (grade 5-7)	0.659	0.163	0.642	0.137	0.601	0.107	*a
Average price received for high-quality fruit (in US$)	0.301	0.040	0.298	0.026	0.310	0.075	
Days to payment according to agreement	25.535	7.454	17.945	6.267	15.756	13.837	***a,c
Days to payment in reality	48.930	40.197	30.400	36.705	26.156	32.269	***a,c
Relational capital							
Trust	-0.167	1.010	0.290	0.905	-0.094	0.956	**c
Loyalty	0.150	0.856	0.053	1.197	-0.314	0.816	

Source: own elaboration; ***(**)[*] significant at 1%(5%)[10%] probability of error; a=significant difference between signed contract and no agreement; b= significant difference between verbal agreement and no agreement; c=significant difference between signed contract and verbal agreement.

6.1 Impacts on pineapple revenues

Table 5 presents unbiased average treatment effects for farmers with formal and informal marketing agreements. The first and second rows of Table 5 compare farmers with informal contracts and farmers with formal contracts to farmers selling their produce without any prior marketing agreement, respectively. The last row compares farmers with formal contracts to those with informal agreements.

The results show that compared to farmers selling in the spot market, farmers with both formal and informal contracts obtain significantly higher annual net revenues from pineapple cultivation. Producers with formal contracts gain on average 12,336 US$ more than producers without prior agreement, whereas a verbal agreement increases net revenue by 11,541 US$. However, net revenues per hectare are not significantly different between farmers with and without contracts indicating that the positive income effects are mainly due to the larger areas cultivated by contract farmers. Comparing total net revenue between formal and informal contract schemes, we do not find a significant difference; however, per-ha-revenues are slightly higher for farmers with verbal agreements (significant at the 10% level).

Table 5: Impact on outcome variables (matched cases)

	Verbal vs. none ATT	Signed vs. none ATT	Signed vs. verbal ATT
Net revenues			
Net revenue from pineapple	11541***	12336 ***	-7597
Net revenue per ha	-1224	-1112	-2618 *
Transaction risks			
Pineapple rejections (in %)	0.025*	0.064 **	0.041
Informed about reason	0.283***	0.156	-0.060
Percentage graded as high quality (grade 5-7)	0.044*	0.059 **	-0.001
Average price received for high-quality fruit (in US$)	-0.016	0.005	-0.001
Days to payment according to agreement	1.995	9.310 ***	5.609 ***
Days to payment in reality	4.441	26.765 ***	8.350
Relational capital			
Trust	0.426**	-0.202	-0.329 **
Loyalty	0.379**	0.535 ***	0.031
Matched cases (common support)	54/45	71/24	71/32

Source: own elaboration; ***(**)[*] significant at 1%(5%)[10%] probability of error.

6.2 Impacts on transaction risks

As described before, producers in the pineapple sector face multiple risks along the different marketing stages. We expect contractual relationships between buyers and producers to improve coordination and thereby reduce uncertainties in the supply chain. This should be reflected in lower rejection rates, higher quality grades, and better prices for farmers participating in contract schemes. Table 5 compares transaction risks across different market arrangements. While one would expect that closer vertical coordination leads to the more efficient transmission of relevant information regarding product requirements along the value chain and thereby reduces rejection rates, we find that rejection rates are higher in both formal and informal contract schemes. At least farmers with verbal agreements seem to be better informed about the reasons for rejection as compared to farmers without agreement. The existence of such communication flows can be considered as a minimum requirement for improving the supply chain relationship in the future.

While they suffer from higher rejection rates, on the other hand, we also find that farmers with formal and informal contracts achieve good quality grades (grades 5 to 7) for a larger percentage of their pineapples. As shown before, farmers often can access extension and credit through the contracts, which we find reflected in higher quality output. Beyond this positive effect on product quality, other tangible benefits seem to be limited. With respect to the price obtained for high quality pineapples, we do not find a significant difference between farmers with formal, informal or no agreement.

Finally, farmers with a formal contract have to wait significantly longer for their payments. In addition to longer payment periods, farmers with written contracts also suffered from significantly longer payment delays. Altogether, the results indicate that major risks such as high rejection rates and long payment delays are not solved, but rather aggravated in particular in formal contract schemes.

6.3 Implications for relational capital

The sustainability of the supply chain relationship is not only reflected in tangible benefits, but also depends on the relational capital build between producer and buyer. Two important aspects of relational capital include a trustful relationship and loyalty, which are important for the relationship to persist in the long-term. During the interviews, farmers were asked to rate different statements regarding trust and loyalty with their main buyer on a five-point Likert scale. Based on these statements two constructs were identified using principal component analysis. A description of these

two constructs is provided in Table 6. The derived constructs have a mean value of zero and a standard deviation of one. Accordingly, higher values of the construct indicate higher levels of trust and loyalty.

Table 6: Description of constructs

Construct	Cronbach's Alpha	Item	Load
Trust	0.856	I think that my buyer has been trustful during the time I have dealt with him	0.833
		I will not say negative comments about my buyer to my friends and family	0.818
		I would recommend my buyer to my friends and family who grow pineapple	0.811
		In general, I think that my buyer has been honest with me	0.737
Loyalty	0.606	If my buyer would lower the price he pays for the product, I would still work with him	0.763
		I would not switch to another buyer even if he offers me a better price for my product	0.743
		As long as I live here and harvest pineapple, I do not feel the need to look for another buyer	0.663

Source: own elaboration

The comparison of relational capital across different market arrangements is presented in Table 5. Results show that relational capital figures most strongly in verbal agreements. Producers' trust in their buyers is significantly higher compared to both formal contracts and spot market transactions. In addition, loyalty is significantly higher in verbal market arrangements compared to spot market relationships, where producers rely on arm's length transactions.

In formal contracts, farmers display low levels of trust, which is comparable to the level of trust in open spot market transactions. Several farmers indicated that this is due to the long payment delays and high rejection rates that they have experienced in the past. On the other hand, loyalty within formal relationships is significantly higher than in open spot market transactions, mostly due to the legally binding character of the written agreement preventing farmers from switching buyers in the short run. In contrast, in the open spot market farmers normally choose the buyer offering the best prices at the time of harvest.

7 Conclusions

Previous studies have documented the emergence of private contract schemes that aim at supporting farm-level adaptation (e.g. Le Coq et al. 2010). Most studies focusing on a particular outgrower scheme have been optimistic about the ability of these private-sector initiatives to support small-scale farmers in their upgrading process. In this study, taking into account verbal and written contracts between pineapple producers and several downstream buyers, we find that contracts can act as an important catalyst for standard implementation and that contract farmers derive higher net revenues from pineapple production. Yet, we believe that some caution is warranted given that major uncertainties faced by farmers in the supply chain are not resolved. In order to build sustainable value chains that are beneficial to both farmers and buyers in the long-term, communication and information flows along the supply chain need to be improved. In particular, long payment delays and high rejection rates reduce farmers' trust in the marketing relationship. Anecdotal evidence from the Costa Rican pineapple sector reveals that disadoption rates of standards are high among small and medium-scale producers due to the fact that farmers do not perceive a strong benefit in terms of market access (high rejection rates) or monetary compensation (no price premiums, long payment delays). Further research is needed that looks into the long-term sustainability of private-sector contract schemes and standard adoption.

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